Listing of Claims:

1. (previously amended) A zone arc fault detection system for detecting series and parallel arcing faults in a defined zone of an electrical circuit supplying electrical power to a load, comprising:

a single pair of substantially identical parallel insulated load conductors for each zone in which arcing is to be detected, thereby defining a detection zone comprising the length of said parallel conductors between end points where the two conductors are electrically coupled together;

a balancing core operatively associated with said pair of parallel load conductors; and

a current sensor operatively associated with each said pair of parallel load conductors;

wherein said current sensor produces a signal representative of the difference in the current flow in the two conductors.

2. (original) The system of claim 1 wherein said current sensor comprises a current transformer having a high permeability core.

3. (original) The system of claim 1 wherein said current sensor comprises a Hall effect sensor.

4. (original) The system of claim 1 wherein said current sensor comprises a low magnetic permeability di/dt current sensor.

5. (original) The system of claim 4 wherein said current sensor comprises an air core toroid.

6. (original) The system of claim 5 wherein said current sensor comprises a flexible Rogowski coil formed into a figure 8 configuration.

7. (original) The system of claim 4 wherein the current sensor produces a signal proportional to the difference between the time derivatives of the current in each conductor and further including a circuit for integrating and filtering said sensor signal to produce a signal proportional to the current difference between said conductors.

8. (original) The system of claim 1 wherein said current sensor comprises a resistive shunt constructed so as to produce a voltage difference proportional to the difference in current between said conductors.

9. (original) The system of claim 1 wherein said current sensor comprises a magnetic core and a coil wound around said core, said load conductors being operatively coupled with said coil such that magnetic fields of said conductors oppose each other.

10. (original) The system of claim 9 and further including an armature attracted by said magnetic core in response to a current difference in said conductors.

11. (original) The system of claim 1 wherein said current sensor comprises a differential current sensor which produces a predetermined motion in response to the current difference between the conductors.

12. (original) The system of claim 11 wherein said differential current sensor comprises a bi-metal element.

13. (original) The system of claim 1 and further including a fault detector circuit operatively coupled with said current sensor.

14. (original) The system of claim 13 and further including a circuit breaker responsive to said fault detector circuit.

15. (original) The system of claim 1 and further including a circuit breaker responsive to said differential current.

16. (original) The system of claim 1 and further including a relay operatively coupled with said circuit breaker, said relay being responsive to said differential current for operating said circuit breaker.

17. (previously amended) A method for detecting series and parallel arcing faults in a defined zone of an electrical circuit supplying electrical power to a load, comprising:

splitting a load conductor in each said defined zone into a single pair of substantially identical parallel insulated conductors, and electrically coupling and terminating the endpoints of said conductors together, so that each of said conductors carries substantially half the total phase current during normal operating conditions, thereby defining a detection zone comprising the length of said parallel conductors between the end points where the two conductors are electrically coupled together;

providing a differential current sensor operatively associated with each said pair of parallel conductors a signal representative of the difference in the current flow of the two conductors; and

providing a detectable current unbalance in the presence of said parallel fault by inducing mutually canceling insertion impedances in said pair of parallel load conductors.

18. (original) The method of claim 17 wherein said current sensor comprises a current transformer having a high permeability core.

19. (original) The method of claim 17 wherein said current sensor comprises a Hall effect sensor.

20. (original) The method of claim 17 wherein said current sensor comprises a low magnetic permeability di/dt current sensor.

21. (original) The method of claim 20 wherein said current sensor comprises an air core toroid.

22. (original) The method of claim 21 wherein said current sensor comprises a flexible Rogowski coil formed into a figure 8 configuration.

23. (original) The method of claim 20, including producing a signal proportional to the difference between the time derivatives between the current in each conductor and further including integrating and filtering said sensor signal to produce a signal proportional to the current difference between said conductors.

24. (original) The method of claim 17 wherein configuring and arranging said current sensor comprises constructing a resistive shunt so as to produce a voltage difference proportional to the difference in current between said conductors.

25. (original) The method of claim 17 wherein configuring and arranging said current sensor comprises coupling said load conductors with a coil wound around a magnetic core.

26. (original) The method of claim 25 wherein configuring and arranging said current further includes providing an armature attracted by said magnetic core in response to a current difference in said conductors.

27. (original) The method of claim 17 wherein configuring and arranging said current sensor comprises providing a differential current sensor which produces a predetermined motion in response to the current difference between the conductors.

28. (original) The method of claim 27 wherein said differential current sensor comprises a bi-metal element.

29. (original) The method of claim 17 and further including coupling a fault detector circuit with said current sensor.

30. (original) The method of claim 29 and further including providing a circuit breaker coupled for response to said fault detector circuit.

31. (original) The method of claim 17 and further including providing a circuit breaker coupled for response to said differential current.

32. (original) The method of claim 17 and further including operatively coupling a relay with said circuit breaker for responding to said differential current for operating said circuit breaker.

33. (previously added) The system of claim 1 wherein each of the individual conductors of said pair of load conductors is essentially half the size required of a single load conductor for the total phase current under normal operating conditions of said load.

34. (previously added) The method of claim 17 wherein each of the individual conductors of said pair of load conductors is essentially half the size required of a single load conductor for the total phase current under normal operating conditions of said load.

35. (previously added) A zone arc fault detection system for detecting arcing faults in a defined zone of an electrical circuit supplying electrical power to a load, comprising:

a single pair of substantially identical parallel insulated load conductors each of which is essentially half the size required of a single load conductor for the total phase current under normal operating conditions of said load;

a balancing core operatively associated with each said pair of parallel load conductors; and

a current sensor operatively associated with each said pair of parallel load conductors, said current sensor and said conductors being respectively configured and arranged such that the current sensor produces a signal representative of the difference in the current flow in the two conductors.

36. (previously added) A system of claim 35 wherein said electrical circuit supplying electrical power to a load is installed in an aircraft.

37. (previously added) A system of claim 36 and further wherein a conductive frame of said aircraft provides a neutral current return connection.

38. (previously added) A method for detecting series and parallel arcing faults in a defined zone of an electrical circuit supplying a load, comprising:

splitting a load conductor in each said defined zone into a single pair of substantially identical parallel insulated conductors each of which is essentially half the size required of a single load conductor for the total phase current under normal operating conditions of said load;

providing balanced insertion impedances in said pair of conductors to enhance current unbalance detection during said parallel arcing fault;

providing a current sensor operatively associated with each said pair of parallel conductors; and

configuring and arranging a current sensor and said conductors such that the current sensor produces a signal representative of the difference in the current flow of the two conductors.

39. (previously added) A system of claim 38 wherein said electrical circuit supplying electrical power to a load is installed in an aircraft.

40. (previously added) A system of claim 39 and further wherein a conductive frame of said aircraft provides a neutral current return connection.